

# GPS MONITORING OF CRUSTAL DEFORMATION AND THE EARTHQUAKE CYCLE IN COSTA RICA

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## ABSTRACT

### I. Objectives

- i) Establish a base set of GPS measurements in the Nicoya Peninsula region of Costa Rica, a high probability seismic gap,
- ii) Quantify crustal deformation in the Nicoya Peninsula and Pacific coastal region of Costa Rica associated with elastic strain accumulation at the Middle America Trench,
- iii) Determine the post-seismic deformation in the Caribbean coastal region of Costa Rica related to the 1991 earthquake and quantify the effective viscosity of the lower crust and upper mantle.
- iv) Assess models of seismic strain accumulation in the Nicoya region and post-seismic deformation for the region affected by the 1991 earthquake using the GPS measurement solutions, and integrate this information with regional GPS surveys to understand the effect these processes have on regional tectonic models.
- v) Determine the location and distribution of motion associated with the inland continuation of the North Panama Deformed Belt (the feature associated with the 22 April 1991 Costa Rica earthquake) into Costa Rica. How discrete a boundary is it and where does it intersect the Middle America Trench (if at all)?

### II. Approach

- i) Use TurboRogue GPS receivers to measure site positions across a geodetic network which has already been established as part of the CASA and CORBAS GPS experiments and densify the network as needed.
- ii) Take two sets of GPS measurements, in 1994 and 1996, with additional surveys to be conducted beyond 1996.
- iii) After a large earthquake in the Nicoya seismic gap, deploy a field campaign to obtain co-seismic and post-seismic GPS measurements.

### III. Anticipated Results

- i) Two sets of geodetic measurements which will form the basis for a rapid deployment survey of co- and Post-seismic deformation following a large earthquake off the Nicoya Peninsula and Pacific coast of Costa Rica.
- ii) Post-seismic deformation amounts associated with the 1991 Costa Rica earthquake and the effective viscosity of the lower crust and upper mantle. This will constrain the time-scale over which seismic relaxation occurs and optimize the temporal sampling in future co-/post-seismic investigations.
- iii) Quantification of crustal strain accumulation in the Nicoya region, The distribution and rate of inter-seismic deformation will be used to model the lateral and depth extent of the locked fault interface at the Nicoya Peninsula and will constrain regional tectonic models that incorporate the Liberia and Limon GPS sites which lie in the Nicoya and Caribbean coastal regions respectively.
- iv) Identification of the location of the inland continuation of the NPDB into Costa Rica and a more accurate assessment of the tectonic setting of sites such as Liberia in NW

Costa Rica which may be undergoing deformation related to both, seismic strain accumulation, and the secular plate motions associated with its location on either the Caribbean or Panama plates.